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Redescription of the red-striped soft scale, *Pulvinaria tenuivalvata* (Newstead), with a new synonymy (Hemiptera, Coccomorpha, Coccidae)

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Abstract

The soft scale, *Pulvinaria tenuivalvata* (Newstead, 1911), is a major pest of sugarcane in Egypt. This paper provides a redescription and illustration of the adult female based on a microscopic study of the morphology of several adult female specimens and of the type series illustrated by De Lotto (1965) on citronella grass from Uganda. Two paratypes of *Pulvinaria saccharia* De Lotto, 1964 are also studied and the name is placed here as a junior synonym of *P. tenuivalvata*.

Keywords

Coccidae, Egypt, pest, sugarcane, synonymy

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Introduction

Sugarcane, *Saccharum officinarum* L. (Poaceae) is one of the main crops in Egypt, and the control of pests on this crop is very important. The red-striped soft scale *Pulvinaria tenuivalvata* is a major pest since 1992, when it was observed for the first time and named as *Pulvinaria elongata* Newstead (Karam and Abou-Alkhair 1992). It attacks leaves, causing a major reduction in crop yield due to depletion of sap, production of honeydew and growth of sooty mould. Early and heavy infestations have resulted in complete yield lost (El-Serwy et al. 2008).

The species was described by Newstead (1911) as *Lecanium tenuivalvatum*, based on adult females, all of which were heavily parasitisied, infesting citronella grass (*Cymbopogon citratus*) in Uganda. De Lotto (1964) described and illustrated for the first time *Pulvinaria saccharia* collected on leaves of sugar cane in Durban, Natal, and stated that the species is structurally very closely related to *Pulvinaria tenuivalvata* (Newstead, 1911). The same author (De Lotto 1965) redescribed and illustrated the adult female of *Pulvinaria tenuivalvata* from a single specimen from the type locality and the type host plant. Williams (1982), in his study of *Pulvinaria iceryi* (Signoret) and its allies on sugarcane and other grasses, separated *P. tenuivalvata* from five *Pulvinaria* species, giving a key and commenting on the great similarity of these five species, *P. elongata* Newstead, *P. iceryi* (Signoret), *P. saccharia* De Lotto, *P. sorghicola* De Lotto and *P. tenuivalvata* (Newstead). He stated that *P. tenuivalvata* is very close to *P. saccharia*. Watson and Foldi (2002) discussed the identity of the pest on sugarcane in Egypt and identified the species as *Pulvinaria tenuivalvata* (Newstead), although it had previously been identified as *Pulvinaria elongata* Newstead (Karam and Abu-Elkhair 1992) and *Saccharolecanium krugeri* (Zehntner) (Ali et al. 1997). In 2001, Ghabbour and Hodgson described and illustrated the 1st instar nymph and 2nd and 3rd instar female nymphs of *P. tenuivalvata* and provided a key.

The present paper redescribes and illustrates the adult female of *Pulvinaria tenuivalvata* (Newstead) in detail. In addition, we were able to study two paratypes of *Pulvinaria saccharia* De Lotto, 1964 and conclude that the name *Pulvinaria saccharia* is a junior synonym of the name *Pulvinaria tenuivalvata*.

Materials and methods

Slide-mounted adult females were studied from the entomology collections at The Natural History Museum, London, U.K. (**BMNH**) and Muséum national d'Histoire naturelle, Paris, France (**MNHN**). The photos were produced using with a Leica DFC 420 camera and the software Leica Application Suite, version 2.8.1. The drawings were made using the software Illustrator CS6 version 16.0.0. Morphological terms follow those by Hodgson (1994) and Qin and Gullan (1992).

Taxonomy

Pulvinaria tenuivalvata Newstead, 1911

Lecanium tenuivalvatum Newstead, 1911: 92.
Pulvinaria tenuivalvata (Newstead), De Lotto 1965: 217.
Pulvinaria elongata Newstead; Karam and Abu-Elkhair 1992: 587, misidentification.
Saccharolecanium krugeri (Zehntner); Ali et al. 1997: 149, misidentification.
Pulvinaria saccharia De Lotto, 1964: 863, 2 paratype adult females, South Africa, Natal, Durban, on *Saccharum officinarum*, J. Munting, 25/03/1964 (BMNH); De Lotto 1966: 468; Hodgson 1968: 207; 1969: 29, 30; Qin and Gullan 1992: 121. **syn. n.**

Description of the adult female. Figs 1–6. The adult female of *P. tenuivalvata* is very elongate, convex with the cephalic region flattened. The body colour varies from pale crimson to flesh-coloured with two irregular longitudinal bands of bright crimson on the dorsum. No true ovisac is formed, except under the body where it extends forward to the eyes and may project slightly from beneath the female body.

Body (Fig. 1A): very elongate, oval, narrow at both ends, 3.4–6.5 mm long, 1.5–2.5 mm wide. Derm membranous. Anal cleft rather shallow ranged from 0.70 to 0.74 mm in length. Stigmatic clefts poorly developed.

Margin: marginal setae (Fig. 1B) numerous, slender and pointed, with well-developed basal-sockets, distributed in one row with 12-18 setae on each side between the anterior and posterior stigmatic clefts, mostly about 35–40 μm long, a few only approximately 20 μm long, the longest setae similar in length to the median stigmatic setae (Fig. 2A). Three stigmatic setae present (Fig. 1F) in each stigmatic cleft; these setae short, stout, pointed, the median seta longest (Fig. 2B), straight or more-or-less curved, variable in size and thickness, 25–40 μm long, lateral spiracular setae also variable in size and shape, each 15–20 μm long, pointed (Figs 2B, 5A).

Dorsum: dorsal setae (Fig. 1G) stout, conical, 10–15 μm long, not lanceolate (Fig. 6), scattered all over body surface. Submarginal tubercles absent. Preopercular pores minute (Fig. 1D) about 3 μm in diameter, grouped in small number (6–18) anteriorly to the anal plates. Filamentous pores minute (Fig. 1E), evenly distributed. Anal plates (Fig. 1C1) together quadrate, each plate 125–140 μm long and 70–75 μm wide. Each plate with four short setae; one apical, one subapical, one inner margin seta and one outer margin seta. Ano-genital fold (Fig. $1C_2$ with two pairs of long anterior marginal setae (a median pair each nearly 45 μm long and a submedian pair each around 65 μm long) and three pairs of long lateral margin setae, 55–65 μm. Anal ring with four pairs of long setae and two rows of pores.

Venter: submarginal setae (Fig. 1J) setose, approx. 7 μm long, placed in a submarginal row. Interantennal setae long, present in three pairs. Prevulvar setae long, one pair on each of the three prevulvar segments. Minute ventral setae evenly distributed. Antennae well developed, eight segmented (Figs 1H, 4), 300–370 μm long, 3rd segment longest. Legs

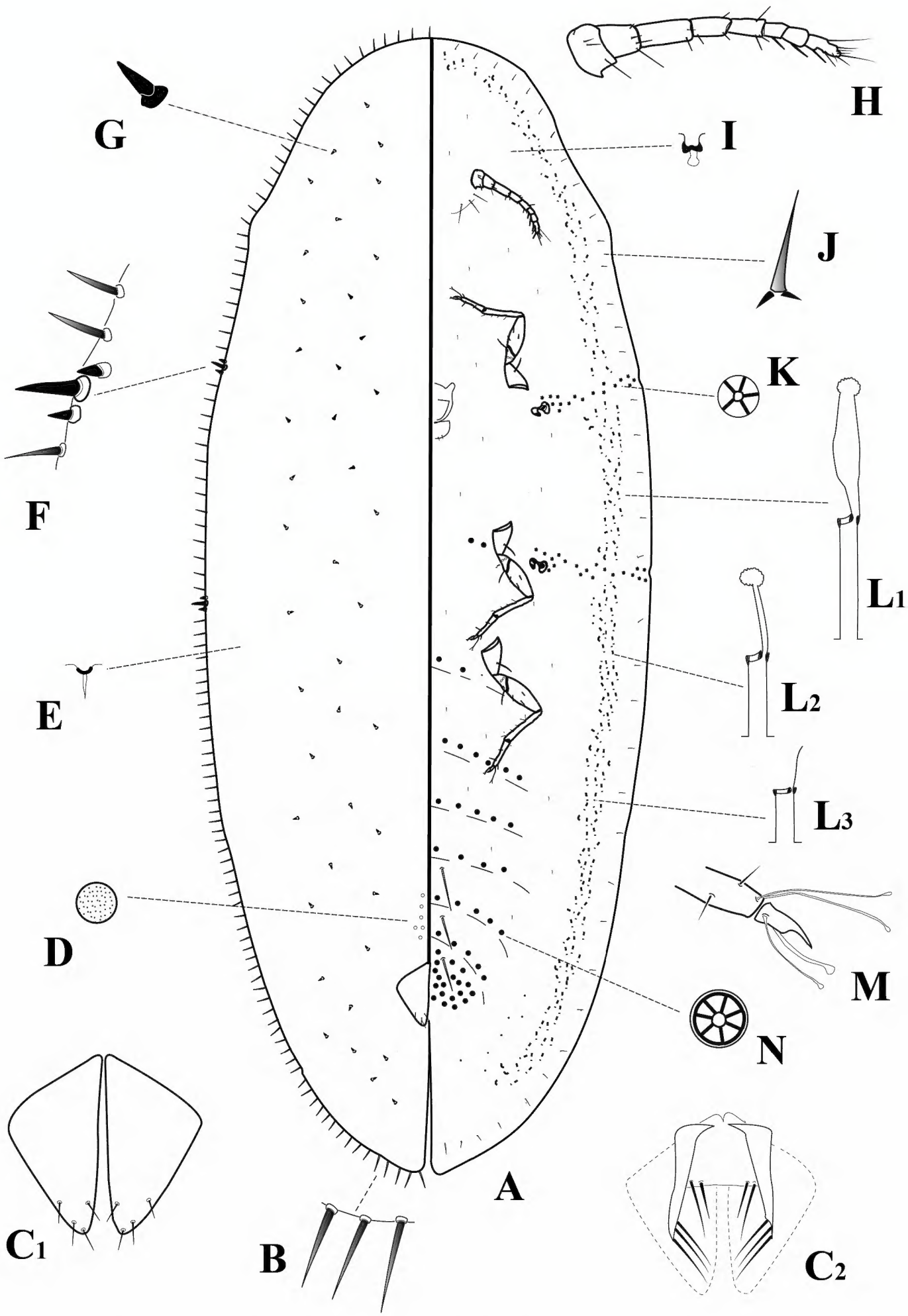
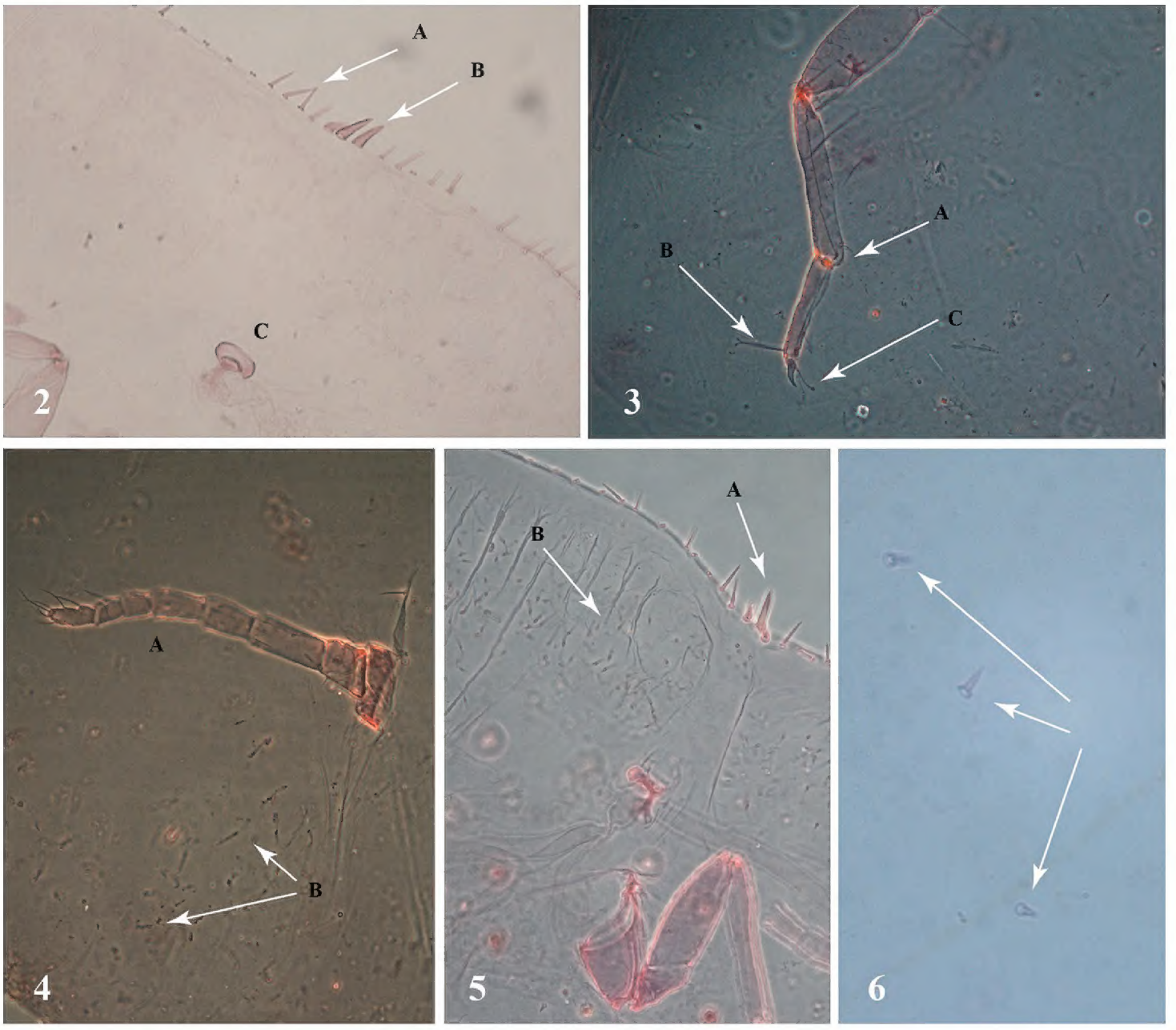


Figure 1. *Pulvinaria tenuivalvata* (Newstead). **A** Body, venter and dorsum **B** marginal setae **C1** anal plates, dorsal view **C2** ano-genital fold **D** dorsal discoidal pore **E** dorsal filamentous pore **F** spiracular setae **G** dorsal seta **H** antenna **I** ventral microduct **J** ventral submarginal seta **K** spiracular disc-pore **L** ventral tubular ducts of three types: L1, type I, L2, type II, L3, type III **M** claw digitules unequal **N** multilocular disc-pore.



Figures 2–6. *Pulvinaria tenuivalvata* (Newstead). **2A** marginal setae **2B** anterior spiracular setae **2C** anterior spiracle **3A** tibio-tarsal articulatory sclerosis **3B** tarsal digitules **3**, claw digitules unequal **4A** antenna **4B** ventral tubular ducts of the type I **5A** posterior spiracular setae **5B** ventral tubular ducts of the type I **6** dorsal conical setae.

well developed, each with a distinct tibio-tarsal articulatory sclerosis (Fig. 3A), claw without distinct denticle (Fig. 3C). Tarsal digitules, slender, knobbed at apex (Figs 1M, 3B), 45–50 μm long. Hind trochanter + femur 200–260 μm long. Claw digitules unequal, one twice diameter of other, both slender, of the same length, each slightly knobbed at the apex (Figs 1M, 3C), 35–40 μm long. Anterior and posterior spiracles well-developed. Spiracular disc-pores (Fig. 1K) with five loculi, some with four or three loculi, 3–4 μm in diameter, present in a narrow band extending from each spiracle to margin. Multilocular disc-pores (Fig. 1N) with 7–8 loculi, some pores occasionally with fewer loculi, approx. 5 μm in diameter, numerous around vulva, in single rows on all preceding abdominal segments and a few present, submedially, on metathorax and mesothorax. Ventral microducts present, minute (Fig. 1I), sparse. Ventral tubular ducts (Fig. 1L) in a submarginal band, 4 - 6 ducts wide, numerous around entire body, except caudal area and head region where they are sparse. Three types of ventral tubular ducts are present, all of similar diam-

eter. Type I (Fig. 1L1) long and narrow, numerous, with outer ductule about 20 μm long, approx. 3 μm in diameter, inner ductule approx. 24 μm long, longer and wider than outer ductule and with a large terminal gland. Type II (Fig. 1L2) shorter than type I, less numerous, 10 μm long and 3 μm in diameter, inner ductule 7 μm long, narrower than outer one and with a terminal gland. Type III (Fig. 1L3), the shortest, with outer ductule 5 μm long and inner ductule slender and short, without a terminal gland, very few in number.

Material examined. Egypt: 100 km south of Cairo, Benisueif, on sugarcane and rarely on maize, M.A. Shalaby, ? 1997 (BMNH); upper Egypt, Giza, on sugarcane leaves, 1997 (BMNH); Qena Governorate, Luxor and Qus (700 km south of Cairo), on undersides of sugarcane leaves, S.A. El-Serwy, 01/1999 (BMNH); Giza region, 40-80 km south of Cairo, on *Saccharum officinarum* (commercial), S.A. El-Serwy, 10/08/1999 (BMNH); upper Egypt, Qena Governorate, on sugarcane leaves, 12/2000 (BMNH); on sugarcane, S. Ramadan, 2011 (MNHN). **Uganda:** Entebbe, on citronella grass, C.C. Gowdey, 18/02/1910, G. De Lotto, 1960, B.M. 1963-473 (BMNH). **South Africa**, Natal, Durban, on *Saccharum officinarum*, J. Munting, 25/03/1964, *Pulvinaria saccharia*, 2 paratypes, B.M. 1964-662 (BMNH).

Host plants. The main host plant in Egypt is sugarcane, *Saccharum officinarum*, but it has also been recorded from several other Poaceae in Egypt: *Imperata cylindrica*, *Sorghum vulgare saccharatum*, and *Zea mays*. The species is known on *Cymbopogon citratus* (citronella grass) and *Pennisetum purpureum* in Uganda (García Morales et al. 2016), and from Zimbabwe and South Africa (Natal), on *Saccharum officinarum* (as *P. saccharia*).

Comments. Two paratypes of *Pulvinaria saccharia* De Lotto, 1964, have been examined, both adult females. The dorsal setae are short, strong and spiniform, but certainly not lanceolate as stated by the previous authors (De Lotto 1964; Williams 1982). The claw digitules are unequal, one much thicker than the other one, but of the same length. This character was first observed by De Lotto (1964; 1965) and confirmed by Williams (1982) and Watson and Foldi (2002). These two paratypes show the presence of three types of ventral submarginal tubular ducts, as always. *Pulvinaria saccharia* has ventral multilocular disc-pores on the metathorax and the mesothorax. The range of setae between the anterior and the posterior spiracles is about 29-31. The combined length of hind trochanter plus femur is about 200–220 μm. On the appearance in life of *P. saccharia*, De Lotto (1964) mentioned that "*P. saccharia does not form any ovisac but a thin layer of white cottony wax laid beneath the body along the margin*". A similar type of ovisac on adult females of *P. tenuivalvata* was observed in Egypt. All these characters fall within the range of the morphological characters of *P. tenuivalvata*, so *P. saccharia* is here treated as a synonym of *P. tenuivalvata*.

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